

Physics-Based Selection of SLM Process Parameters to Mitigate Defects and to Control Deposit Microstructure, Phase I

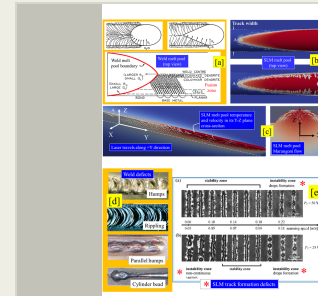
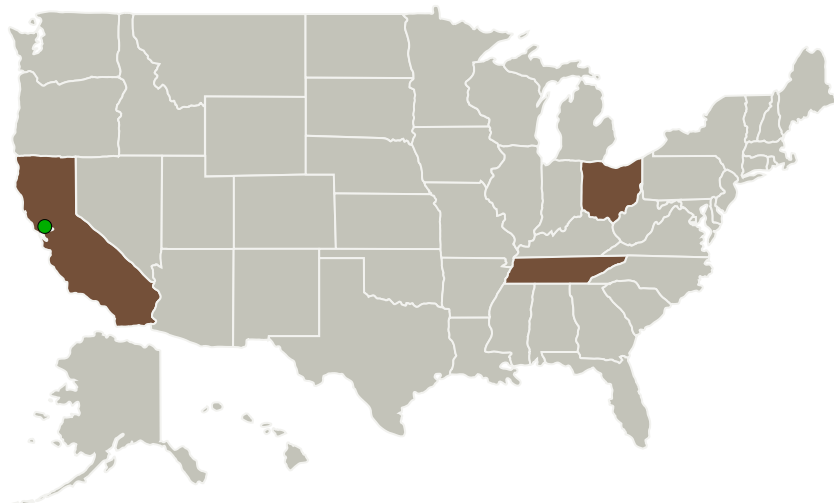
Completed Technology Project (2014 - 2014)



Project Introduction

The research objectives of this proposal are to: (1) To adapt the thermal-fluid science procedures for the prediction of weld defects to the prediction and control of surface defects and melt pool instability during the deposition of single tracks in SLM and to control the as-deposited microstructure. (2) Utilize physics-based analysis to predict variability caused in the individual SLM track cross-section geometry due to the statistical distribution of powder particles sizes and the potential non-uniform placement of powder particles during recoating. This will also include performing statistical analysis of the variability and to develop a probabilistic model to calculate levels of confidence and exceedance for the size and type of potential defects as a function of the SLM process parameters. (3) Determine the thermal cycling during deposition and use it to predict solidification microstructure and solid state transformations during deposition; and (4) Demonstrate feasibility of the analytical procedures for alloy IN718.

Primary U.S. Work Locations and Key Partners



Physics-based selection of SLM process parameters to mitigate defects and to control deposit microstructure Project Image

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Organizations Performing Work	Role	Type	Location
Applied Optimization, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Fairborn, Ohio
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
The University of Tennessee-Knoxville(UT-K)	Supporting Organization	Academia	Knoxville, Tennessee

Primary U.S. Work Locations

California	Ohio
Tennessee	

Project Transitions

▶ **June 2014:** Project Start

✓ **December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140746>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied Optimization, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

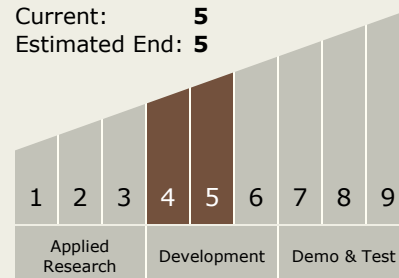
Carlos Torrez

Principal Investigator:

Anil B Chaudhary

Technology Maturity (TRL)

Start: 4
Current: 5
Estimated End: 5

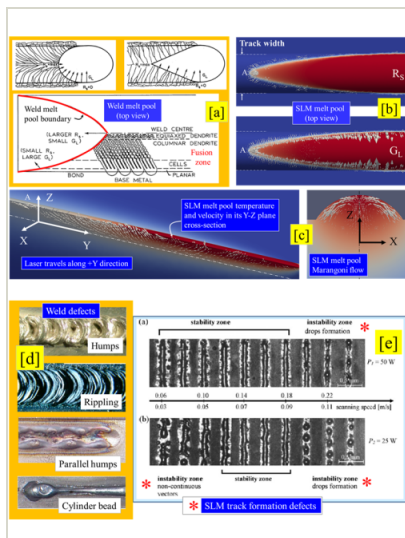


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Images



Project Image

Physics-based selection of SLM process parameters to mitigate defects and to control deposit microstructure Project Image (<https://techport.nasa.gov/image/130716>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System